Pushing the Envelope on Waste Reduction and Recovery

The Solid Waste Association of North America (SWANA)

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Executive Summary

This document sets forth SWANA's strategy for significantly increasing the rates of municipal solid waste reduction and recovery in North America and makes a series of policy recommendations that would remove barriers to and provide incentives for achieving higher levels of waste reduction and recovery. It is intended to be a *living document* designed to communicate, stimulate discussion and solicit comments on the ideas and concepts presented. Accordingly it will be widely distributed to Federal, State and Provincial legislators and policy makers, local governmental officials, solid waste management professionals, the media and the general public. The document will be modified in the future based on the commentary received.

In developing this strategy, SWANA supports a comprehensive integrated solid waste management approach that incorporates a broad range of source reduction, materials recycling and energy recovery activities to reduce and recover value from municipal solid wastes. SWANA believes that there is significant opportunity to increase reduction and recovery levels by working across the board and encouraging reduction and recovery in many forms, wherever it can be achieved in an environmentally and economically sound manner. Furthermore, since there are technical, economic and budgetary constraints to increasing waste reduction and recovery levels, SWANA believes providing a broad range of solid waste reduction and recovery options will allow market forces to work to increase reduction and recovery rates in the most economical and efficient manner.

The document first reviews the most recent US EPA data on solid waste generation, recovery and disposal along with the trends in this data over the past two decades. Based on this data SWANA concludes the following:

- Even though the economy grew dramatically over the last decade, the per capita waste generation rate has actually leveled off and remained steady since 1990. This suggests that waste generation continues to increase primarily because the population is increasing and not because of an inherent increase in wastefulness by consumers and industry.

- The overall reduction and recovery rate in the year 2000 was over 50 percent when all forms of source reduction, recycling, composting and energy recovery are included. In year 2000, 30 percent of the solid waste generated was recycled or composted, 15 percent was recovered through waste-to-energy systems, and waste generation was reduced at the source by nearly 20 percent.

- Over the past decade the quantity of municipal solid waste disposed of in landfills has actually declined by 9 percent, even though the total waste generated has increased due to population growth. This fact alone testifies to the outstanding success of municipal solid waste reduction and recovery programs in North America.

The document then presents several projections for future solid waste reduction and recovery levels. SWANA concludes that increasing the overall reduction and recovery rate to 65 percent over a ten year period would be an ambitious goal that would require a 28 percent increase in reduction and recovery over current levels while holding per capita waste generation rates level. This probably cannot be achieved without new incentives to encourage across-the-board increases in recovery and reduction levels.

The document concludes with the following policy recommendations that would build upon past successes and create incentives to reduce waste and achieve higher levels of solid waste recovery:

Recommendation 1: Encourage more extensive product stewardship by product designers, manufacturers, retailers and consumers.

Recommendation 2: Expand efforts by Federal, State and Provincial governments to develop markets for recycled materials and recovered energy**.**

Recommendation 3: Provide financial incentives for investments in recycling, composting and the use of recycled materials.

Recommendation 4: Include waste-to-energy and conversion technologies in renewable portfolio standards and green power programs.

Recommendation 5: Encourage the recovery and use of landfill gas by reinstating federal tax credits and through renewable portfolio standards and green power programs.

Recommendation 6: Support technology transfer and research and development efforts that have the potential to significantly increase waste recovery rates, as well as work to reduce the barriers to their implementation.

These recommendations will provide the guiding principles for SWANA and its members to use in advocacy efforts with policy makers, legislators, regulatory agencies, industry and public interest groups.

Introduction

This document sets forth SWANA's strategy for significantly increasing the rates of solid waste reduction and recovery in North America. The heart of this strategy is a series of recommendations for Federal, State and Provincial policy makers that SWANA believes will remove barriers to and provide incentives for achieving higher levels of solid waste reduction and recovery. In developing this strategy, SWANA supports a broad definition of solid waste reduction and recovery consistent with the practice of integrated solid waste management. Integrated solid waste management involves a series of complementary actions to reduce and recover value from wastes through source reduction, reuse, product stewardship, materials recycling, composting, anaerobic digestion, conversion technologies, waste-to-energy, landfill gas recovery and landfill mining. Integrated solid waste management also involves the environmentally sound management and landfill disposal of those wastes that for technical or economic reasons cannot be eliminated or recovered.

This broad definition of solid waste reduction and recovery is embraced for two primary reasons. First, SWANA believes that there is significant opportunity to increase reduction and recovery levels by working across the board and encouraging reduction and recovery in many forms, wherever it can be achieved in an environmentally and economically sound manner. Rather than arguing which method of recovery is better than the others, SWANA believes that a more constructive approach would be to press forward on all fronts and work to expand all of the options for reducing and recovering value from municipal solid wastes. Secondly, SWANA recognizes that there are technical, economic and budgetary constraints to increasing waste reduction and recovery levels and believes that local governments should be provided with a wide range of reduction and recovery options so that they can select what works best for them based on their environmental, economic and public policies and priorities. Providing a broad range of solid waste reduction and recovery options will allow market forces to work to increase reduction and recovery rates in the most economical and efficient manner.

In the remainder of this paper, SWANA will first describe the current and projected levels of solid waste reduction and recovery and will then propose a series of policy recommendations to expand the options for reducing the quantities of and recovering value from municipal solid wastes. These recommendations will provide the guiding principles for SWANA and its members to use in advocacy efforts with policy makers, legislators, regulatory agencies, industry and public interest groups.

Current Levels of Solid Waste Reduction and Recovery

A recently issued EPA report, Municipal Solid Waste 2000 Facts and Figures, presents the most recent data on the current levels of solid waste reduction and recovery in the US.[1] While only providing data for the US, a 1998 Waste Management Industry Survey

[1] SWANA recognizes that there is currently neither a national consensus on the definition of municipal solid waste nor a universally accepted methodology used to calculate the generation, recovery or disposal. Some State and Provincial governments use different methodologies and different definitions of solid waste. Also, other organizations have developed surveys for various purposes. In this document, SWANA uses the EPA data because it has been consistently developed over a 30-year period and is useful for tracking changes and trends.

developed by Statistics Canada shows that the situation is very similar in Canada. The EPA data clearly documents how far we have come in recovering value from municipal solid waste and in actually reducing the amounts of solid waste being produced. Chronicling solid waste generation and recovery rates over the past few decades, EPA finds that we currently recover value, in terms of materials or energy, from over 45 percent of the municipal solid waste that is generated. In addition we have actually reduced waste generation by nearly 20 percent. This results in a combined reduction and recovery rate well in excess of 50 percent (See Table 1).

Table 1
Waste Reduction and Recovery Rate

Waste Generation Before Reduction and Recovery	**287 million tons**
Waste Reduced or Prevented	**55 million tons**
Waste Recycled	**53 million tons**
Waste Composted	**17 million tons**
Waste-to Energy	**34 million tons**
Total Reduced or Recovered	**159 million tons**
Waste Reduction and Recovery Rate (159÷287)	**55 percent**

Source US EPA MSW in the US: 2000 Facts and Figures

This is a very important statistic that is not widely acknowledged and is frequently overlooked in our discussions about solid waste policy and in comparisons of practices in North America with the rest of the world. Here's how the EPA figures stack up.

Waste Generation and Source Reduction. In the US, about 232 million tons of municipal solid waste were generated in 2000. However, according to EPA, 55 million tons of waste were prevented or reduced at the source. Had this not occurred, 20 percent more municipal solid waste would have been generated. Waste reduction (sometimes called source reduction) refers to actions taken to prevent the generation of waste in the first place. This 55 million ton reduction was accomplished through changes in product designs to use less material, and by changes in consumer practices that reduced the amount of waste produced.

The EPA report also shows that, even though the economy grew dramatically over the last decade, the per capita waste generation rate has actually leveled off and has remained steady at about 4.5 lbs. per person per day since 1990.[2] This suggests that

[2] Some States and Provinces include construction and demolition material in the definition of municipal solid waste. This results in a higher per capita generation rate than represented by the EPA data.

waste generation continues to increase primarily because the population is increasing and not because of an inherent increase in wastefulness by consumers and industry.

Recycling and Composting. The EPA report shows that 70 million tons of municipal solid waste were recycled and composted in 2000, which is up over 110 per cent from 33.2 million tons in 1990. This translates into a combined recycling and composting rate of 30 percent of the waste generated in 2000. Since total waste generation has also increased over the past decade, we are now recycling and composting a larger share of a bigger pie.

Energy Recovery from Waste-to-Energy Facilities. In addition to materials recycling and composting, the EPA report indicates that about 15 percent of the municipal solid waste generated was processed by combustion with energy recovery. Waste-to-energy facilities are a clean, reliable method of waste recovery and disposal. In the US, waste-to-energy facilities process 34 million tons of solid waste each year and generate 2,800 MW of renewable energy, which is equivalent to the energy needs of 2.4 million homes. Processing solid waste through waste-to-energy facilities typically achieves a 90 percent reduction in waste volume and a 75 percent reduction in waste weight.

Landfills and Landfill Gas Recovery and Utilization. Not included in the above recovery percentages is the energy recovered from solid waste disposed in landfills from which landfill gas is collected and used as a fuel. Landfill gas, which is 50% methane, can be used in various ways including to generate electricity or directly as a fuel supplementing or replacing fossil fuels. According to data from the EPA Landfill Methane Outreach Program (LMOP), the 360 existing landfill gas recovery projects nationwide currently produce 1,200 MW of energy, which is the equivalent of the energy needs of 1 million homes. SWANA believes that landfill gas recovery and utilization should be accounted for in the National statistics and that this would result in even higher recovery percentages than presented above.

One of the most remarkable trends presented in the EPA report is the significant decrease in the quantities of waste landfilled over the past decade. In 1990 the quantity of municipal solid waste landfilled was 140 million tons. This quantity decreased to 128 million tons landfilled in 2000, a decline of 9 percent. This means that even though the total waste generated has increased due to population growth, the quantities of waste sent to landfill have actually declined. This fact alone testifies to the outstanding success of municipal solid waste reduction and recovery programs in North America.

The next section of this document presents several projections for future reduction and recovery levels.

What is A Reasonable Goal for Waste Reduction and Recovery?

It is very important to have realistic expectations concerning what can be achieved in waste reduction and recovery in the short term (e.g. by 2010). Table 2 presents some projections developed by SWANA using the EPA 2000 data as a baseline.

The first projection, entitled *2010 Status Quo*, assumes no increase or decrease in either the per capita waste generation rate (4.5 lbs/person-day) or the waste recovery and reduction rate (55%) from 2000. This projection assumes no deterioration of the current

situation, where industry and consumers would produce no more waste per capita as in 2000 and that the only increase in waste generation would be from population growth. It also assumes that waste reduction and recovery quantities would increase in proportion to waste generation in order to achieve the same reduction and recovery percentages of a larger total. Under this projection, the quantity of waste reduced and recovered would have to increase by 9 percent from 159 million tons in 2000 to 173 million tons in 2010 just to keep up with the projected population growth.

Table 2
Projections for Waste Reduction and Recovery
(Million tons per year)

	2000 Baseline	2010 Status Quo	2010 at 65%
Waste Generation Before Reduction and Recovery	**287**	**312**	**312**
Waste Reduced and Prevented	**55**	**60**	**70**
Waste Recycled	**53**	**58**	**68**
Waste Composted	**17**	**18**	**22**
Waste-to Energy	**34**	**37**	**43**
Total Reduced or Recovered	**159**	**173**	**203**
Waste Reduction and Recovery	**55 %**	**55%**	**65%**

2010 Status Quo: No increase in per capita waste generation rates and same reduction and recovery rates as in 2000.
2010 at 65%: No increase in per capita waste generation rates and a 65% reduction and recovery rate evenly applied across the board.

The second projection, entitled *2010 at 65%*, assumes no increase in the per capita generation rate and an increase in the recovery and reduction rate to 65%. Under this scenario the quantity of waste reduction and recovery would have to increase 28% from 159 million tons in 2000 to 203 million tons in 2010.

SWANA believes that increasing the reduction and recovery rate to 65 percent by 2010 is an ambitious goal that will require a 28 percent increase in reduction and recovery over current levels while holding per capita waste generation rates level. This probably cannot be achieved without new incentives to encourage across-the-board increases in recovery and reduction levels. At the end of this report SWANA will propose a series of policy recommendations that would provide such incentives. But before that, the report will discuss the implications of attempting to achieve even higher levels of solid waste reduction and recovery.

Why Not Eliminate Waste?

The EPA figures provide an excellent perspective on proposals to completely eliminate waste such as the zero waste approach recently being promoted by various waste

reduction and recycling advocates. The goal of the zero waste proposals is to reduce waste to zero, or as close to zero as possible, by minimizing excess consumption and maximizing the recovery of wastes through recycling and composting. It is this narrow focus on recycling and composting that distinguishes this approach from SWANA's broader approach of encouraging a wider range of source reduction and material and energy recovery options. For example, advocates of zero waste have actually opposed measures that would increase the recovery of energy from solid waste through establishing new waste-to-energy facilities, operating landfills as bioreactors, and providing incentives for landfill gas recovery and utilization. SWANA fully supports the need for increasing recycling and composting levels as important parts of integrated solid waste management. However, SWANA also believes that significantly higher reduction and recovery levels will only be achieved through broader strategies encompassing a wider range of approaches encompassing the recovery of both materials and energy from solid wastes.

Table 3 presents one scenario that illustrates the reduction and recovery levels that would have to be achieved at an 85 percent reduction and recovery rate in 2010.

Table 3
A Waste Elimination Scenario
(Million tons per year)

	2000 Baseline	2010 at 85 %
Waste Generation Due to Population Increase	**287**	**312**
Waste Reduced and Prevented	**55**	**80**
Net Waste Generation After Waste Reduction	**232**	**232**
Waste Recycled	**53**	**115**
Waste Composted	**17**	**36**
Waste-to-Energy	**34**	**34**
Total Reduced or Recovered	**159**	**265**
Waste Reduction and Recovery Rate	**55 %**	**85%**

Assumptions:

1. Waste generation rates decrease to 4 lbs. per person per day offset population increase
2. Waste Reduction and Recovery rate increases to 85% with no increase in Waste-to - Energy

This scenario assumes first that per capita waste generation rates could be reduced to offset the effect of population growth. This means that waste reduction would have to increase by 45 per cent from 55 million tons in 2000 to 80 million tons in 2010 so that the net waste generation remained at the 2000 level of 232 million tons. Secondly this scenario assumes that the overall waste reduction and recovery rate could be increased

to 85 percent through increases in recycling and composting alone. This would require a 117 percent increase in recycling and composting levels over the ten-year period (from 70 million tons of combined recycling and composting in 2000 to150 million tons in 2010.)

This analysis shows that until we can demonstrate that it is feasible to reduce per capita waste generation rates to the point that they at least offset the effect of population growth, while at the same time double existing recycling and composting rates, a strategy aimed at eliminating waste is clearly unattainable. Furthermore, the economic implications of such an approach need to be carefully considered. Extraordinary efforts to reduce waste generation rates would have impacts on the economy and the consumption of goods and products. Attempting to push recycling and composting rates to unprecedented levels, especially in the face of weak recycled material markets, may result in diminishing returns and very high marginal costs. Even if eliminating waste were a technically feasible goal, it would likely be very expensive to achieve over a ten-year period.

Based on these considerations, SWANA believes that a broader approach that encompasses a wider range of materials and energy recovery from solid wastes is a better and potentially more successful strategy for increasing waste reduction and recovery levels. SWANA's approach is very similar to the successful strategies that have been used in Europe and Japan to increase recovery levels. Many of these countries have put in place ambitious programs for increasing product stewardship and recycling and composting levels. However, the countries that have made the greatest progress in recovering value from solid waste have been those that have incorporated energy recovery as part of their National strategies. In fact, in several European countries over 40 percent of the municipal solid waste stream is processed through waste-to-energy facilities.

SWANA concludes that considerable quantities of municipal solid waste are going to continue to be generated into the foreseeable future, and it is imperative that we invest in the facilities and systems to manage them in an economically and environmentally sound manner. Working to eliminate waste can be a positive step to the extent that it focuses attention on waste reduction, encourages product stewardship and identifies creative and practical means to reduce waste. But an unrealistic goal also can be counterproductive if it creates false expectations, drives up costs and discourages investment in improvements in the waste management infrastructure.

Recommended Actions to Increase Reduction and Recovery Levels

In general, the analysis presented above show how far we have come in North America over the last decade in increasing our solid waste reduction and recovery levels. But more can be done by building upon the past successes and creating incentives to reduce waste and achieve higher levels of recovery by implementing the following set of five policy recommendations.

Recommendation 1: Encourage More Extensive Product Stewardship by Product Designers, Manufacturers, Retailers and Consumers. Product stewardship deals with the actions that should be taken to provide for waste management of a product at

the end of its useful life. From a solid waste management perspective, product stewardship involves:

1. Actions to improve the design and manufacture of products to reduce the quantity or toxicity of product waste and facilitate product reuse and recycling.

2. Actions to establish programs to collect, process and reuse or recycle products when they are discarded.

SWANA's Product Stewardship Policy, issued by its International Board of Directors in 2001, focuses on those products for which special handling, recycling, reuse or disposal practices have been established that are above and beyond the conventional solid waste management practices carried out or arranged by local government. The SWANA policy calls on product manufacturers to take on new responsibilities to reduce the adverse impact of their products. However, SWANA recognizes that all participants in a product life cycle - including retailers, consumers and waste managers - have important roles to play working in cooperation with product manufacturers to develop the most workable and cost-effective solutions. Government legislators and regulators have the important role of establishing policies and programs to encourage product stewardship.

SWANA believes that the responsibility for reducing product impacts should be shared among industry (designers, manufacturers, and retailers of products), government, waste managers and consumers. Voluntary stewardship programs, similar to those being developed for electronics products by the National Electronics Products Stewardship Initiative (NEPSI) and through the National Carpet Recycling Agreement should be established for a wider range of consumer products to encourage waste reduction, recycling and reuse. As a major association for solid waste professionals, SWANA will continue to promote product stewardship in our education, training and advocacy programs.

Recommendation 2: Expand Efforts by Federal, State and Provincial Governments to Develop Markets For Recycled Materials and Recovered Energy.

Federal, State and Provincial governments should take a leadership role in the creation and development of markets for products made from materials and energy derived from solid waste. Markets and market development are all about the economics of supply and demand. Currently, demand for recovered materials is weak, there is too much supply and this results in low prices. For example, the market price for residential mixed waste paper at the end of 2002 was well below $4/ton for most of the country. At that low price, it is extremely difficult to operate a cost-effective mixed paper recycling program when you consider the costs for collecting, handling, sorting, and transporting the waste paper. Largely for that reason, curbside recycling of mixed paper has not been included in residential recycling programs in many jurisdictions. Emphasizing the procurement of goods made from recycled material is aimed at strengthening and increasing the demand and markets for recyclable material.

Given the regional, national and international scope of recycling markets, market development needs to come from the top down and is most effective when carried out at the Federal, State and Provincial level. All governmental agencies and departments should create preferential procurement programs for products and energy derived from solid waste. There are substantial opportunities for agencies to procure a myriad of products containing recovered materials including office supplies containing recycled

paper, landscaping materials containing compost and renewable energy recovered through waste-to-energy and landfill gas recovery systems. Actions by local jurisdictions can supplement and complement those of the Federal, State and Provincial agencies.

Recommendation 3: Provide Financial Incentives for Investments in Recycling, Composting and the Use of Recovered Materials. There are some indications that recycling may have hit a plateau. With the depressed market for many recycled materials and the under-developed market for compost, a number of communities are questioning the economic viability of their recycling programs. From a local government perspective, recycling costs money and the sale of recycled material often doesn't cover the costs of collecting and processing it. The problem is that the benefits of recycling and composting accrue globally while the costs are borne locally.

Furthermore there are some developments that could further increase the cost of composting and recycling. For example, in Southern California concerns over air emissions from composting operations have led a major air district to propose covering composting operations and venting them to biofilters. If this type of compost management were to be implemented nationally, the cost of composting could rise dramatically.

Recycling will reduce the need for and the costs of long term care of landfills. These are very real costs and at some point will fall squarely on future generations**.** Recycling also reduces the adverse environmental impacts of mining, harvesting and processing virgin raw materials and significantly reduces the consumption of energy in the form of coal, imported oil and natural gas. Recycling and composting deliver real benefits. Unfortunately, these are not benefits that can easily be quantified and realized by local governments looking at the short-term bottom line.

In order to change the basic economics of recycling and composting, it is imperative to deal with the basic policies that influence decisions about material use. For decades, virgin materials have benefited from a full range of subsidies, tax incentives, depletion allowances, favorable capital gains treatment and other policies to encourage their development and use. These policies have supported the development of a nationwide infrastructure to support the use of virgin instead of recycled materials. It is time for Federal, State and Provincial policy makers to level the economic playing field between these materials. Policy options that should be considered include tax credits for recycled material use, tax free bonds for recycling and composting investments, modification of virgin material subsidies, and other financial measures for recycled materials that would create meaningful incentives for recycling and composting.

As part of this effort it is important to collect data on the full costs and benefits of recycling as compared to the full costs and benefits of landfill disposal so that the appropriate incentive can level the economic playing field in the most direct way possible. These measures would enable local governments to keep and expand the recycling and composting programs they offer, and establish programs with greater breadth and sustainability.

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Recommendation 4: Include Waste-to-Energy and Conversion Technologies in Renewable Portfolio Standards and Green Power Programs. EPA reports issued over the past year demonstrate that capital improvements at waste-to-energy facilities,

resulting from the Clean Air Act regulations, ensure that waste-to-energy is one of the cleanest sources of power in the world. As EPA previously reported in its Mercury Study Report to Congress, mercury emissions from waste-to-energy plants have declined by more than 90 percent from 1995 levels. As a result, waste-to-energy now accounts for less than 3 percent of the U.S. inventory of industrial mercury emissions. EPA also acknowledges that dioxin emissions from waste-to-energy plants had been reduced so dramatically, that in 2002, waste-to-energy would represent less than 1% of the known sources of dioxin.

All of these changes are a result of the significant financial investment made by owners and operators of waste-to-energy facilities in response to the Clean Air Act air maximum achievable control technology (MACT) standards promulgated by the Agency in 1995. Also, in accordance with the federal law, waste-to-energy ash is tested under EPA's Toxicity Characteristic Leaching Procedure, and years of testing ash from every waste-to-energy facility in the country has proven that the ash is not toxic and is safe for disposal and reuse.

Based on all of these significant environmental improvements, policy makers can feel confident in encouraging the use of waste-to-energy as a clean renewable source of energy.

In addition, there are a number of new conversion technologies that use thermal, chemical and biological processes to convert solid wastes into industrial biochemicals and fuels. Most of these conversion technologies are currently at the laboratory or pilot stages of development with very few commercial operations in the North America. The development of these technologies beyond the pilot stage has been hampered by uncertain markets and lack of economic incentives.

As Federal, State and Provincial governments pass legislation deregulating the electricity markets, they should establish Renewable Portfolio Standards that will require electricity generators to provide a certain percentage of their power from renewable fuels and waste-to-energy and conversion technologies should be given full credit as renewable energy supplies. Similarly, as electrical generators offer consumers the opportunity to purchase power from *green* sources, waste-to-energy and conversion technologies should qualify as a green sources. Investment or energy production tax credits for new waste to energy and conversion projects also should be considered. These efforts as a whole would expand the market opportunities for waste-to-energy and conversion technologies and would provide incentives for the construction of new facilities and expansion of existing ones.

In addition, barriers to implementation of new waste-to-energy and conversion technologies need to be addressed. For example, in some states landfill diversion credits are not allowed for any waste-to-energy or conversion technologies. This has inhibited development and application of new technologies. To overcome these and similar obstacles, legislators need to be educated as to the benefit of these technologies and new laws passed recognizing waste-to-energy and conversion technologies as legitimate landfill diversion and recovery options.

Recommendation 5: Encourage the Recovery and Use of Landfill Gas by Reinstating Federal Tax Credits and through Renewable Portfolio Standards and Green Power Programs. A federal tax credit should be provided to encourage the

collection and use of methane gas generated by the decomposition of solid waste in landfills. The methane in landfill gas is a renewable fuel and should be considered such in Renewable Portfolio Standards and green power programs.

Methane is also a potent greenhouse gas and each ton of landfill methane captured and used is equivalent to capturing or reducing 21 tons of carbon dioxide. EPA estimates that the 360 existing landfill gas recovery projects reduce the nation's greenhouse gas emissions by the equivalent of 60 million tons of carbon dioxide per year.

Most of the 360 landfill gas utilization projects currently operating nationwide were made economically feasible by the previous tax credit under Section 29 of the Internal Revenue Code. However, since that credit expired in 1998, it has been unavailable to encourage construction of new landfill gas recovery projects and few have been planned and constructed since that date. Thus, the installation of the more than 600 potential new landfill gas recovery projects identified by EPA depends on the availability of another effective federal tax credit.

If 600 potential landfill gas projects can be brought on line by a new tax credit, they and the 360 existing projects alone could achieve 8 to 10 percent of the greenhouse gas reduction target that was proposed under the Kyoto protocol, by voluntary means and without regulation.

The methane in landfill gas can be collected and converted to electricity, used directly as an industrial boiler fuel, used as a clean-burning vehicle fuel, or used as a hydrogen source for fuel cells. Landfill gas recovery projects and waste-to-energy systems are often located in urban areas allowing them to provide an additional benefit as "distributed" power sources to help improve the reliability of the region's power supply and reduce transmission costs. These projects run on a steady long-term supply of renewable fuel and therefore, can essentially provide an uninterrupted source of electricity.

Recommendation 6: Support Technology Transfer and Research and Development Efforts that Have the Potential to Significantly Increase Waste Recovery Rates. There are a number of promising new technologies that have significant potential for increasing the recovery of materials and energy from municipal solid wastes. There are also considerable opportunities to improve existing recovery and recycling efforts through improved management techniques and modification of programs to increase convenience and efficiency. While this list is not all inclusive, examples of these technologies and techniques include:

- Management systems that provide incentives for recycling through pay-as-you-throw or variable rate programs.
- Approaches that have the potential to lower the costs of collection of recyclables while maintaining value and minimizing residuals e.g. single stream and commingled collection.
- Well-designed public education and information programs that provide compelling and consistent messages to policy makers and citizens alike.
- Opportunities to improve waste composting through techniques such as source separation of residential and commercial organic wastes and enclosed aerated

composting systems and developing new markets for compost in bioremediation and other applications.

- New products designed for ease of recycling and reuse or that increase the use of recycled materials in their design.
- Administrative, financial and operational innovations that improve the overall economic efficiency of recycling such as green purchasing, full-cost accounting, and automated collection services.
- Operating landfills as bioreactors by adding and recirculating liquids to increase methane recovery rates over shorter periods of time. Bioreactor landfills through accelerated waste biodegradation can also increase waste settlement thereby extending landfill life and can reduce long term care requirements through enhanced waste stabilization.
- Conversion technologies that can convert wastes to industrial chemicals and fuels through hydrolysis, anaerobic digestion and gasification.

SWANA believes that a program of research and development on new technologies, along with a sustained effort to transfer knowledge on management and other improvements for existing recovery systems is very important to achieve and maintain higher levels of solid waste recovery.

SWANA fully supports EPA's efforts to encourage research and development by allowing States to authorize research and development at Subtitle D landfills and by establishing the Project XL Program and application of Cooperative Research and Development Agreements. SWANA encourages more extensive R&D and technology transfer activities by Federal, State and Provincial governments, universities and by the private sector. SWANA's Applied Research Foundation can play an important role in stimulation of needed research in conjunction and cooperation with these other entities. SWANA thorough its Specialty Symposia, Annual Conference, workshops, training and certification programs and publications will continue to disseminate this information on a wide scale to its members and other solid waste professionals.